Operating and Installation Manual

EASYLAB controller TCU3

for fume cupboards and air management systems

TROX® TECHNIK

The art of handling air

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TROX® TECHNIK

TROX GmbH

Heinrich-Trox-Platz
47504 Neukirchen-Vluyn, Germany

Phone +49(0)2845 2020
Fax +49(0)2845 202265

E-mail trox@trox.de
www.troxtechnik.com

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1 General information

This manual describes the EASYLAB controller TCU3. It can be used in combination with TROX air terminal units in the TVLK · TVR · TVRK · TVA · TVZ · TVJ · TVT series for controlling variable air flow rates.
The various equipment functions (software) enable the controller to be used in different fields of application:

- Fume cupboard control
- Supply air control
- Extract air control
- Differential pressure control (room or duct pressure)

To ensure complete functioning of the controller, it is essential to read the provided installation manual before starting any work, and to comply with them. The manual must be given to the facilities manager when handing over the system. The facilities manager must include the manual with the system documentation.
The manufacturer does not accept any liability for any malfunction or damage resulting from non-compliance with this manual or non-compliance with relevant statutory regulations.

Other applicable documentation

In addition to this installation manual, the following documents apply:

- Operating manual
  - EasyConnect configuration software (M375DV1)
- Air terminal unit installation manual (E016MA6)
- Installation manual of the EASYLAB components
  - EM-AUTOZERO expansion module (M375DV2)
  - EM-LIGHT expansion module (M375DV3)
  - EM-LON expansion module (M375DV4)
  - EM-TRF/EM-TRF-USV expansion module (M375DV5)
  - Battery pack (M375DV6)
  - BE-SEG control panel (M375DV7)
  - BE-LCD control panel (M375DV8)
  - VS-TRD face velocity transducer (M375DW0)
  - DS-TRD sash distance sensor (M375DW1)
  - EM-BAC-MOD expansion module (M375DW4)
- General wiring documents
- Project-specific wiring documents

Symbols used in this manual

Danger!
Designates danger to life and limb due to electrical voltage.

Note!
Designates important notes or information.

2 Safety and correct use

General information regarding safety

Only skilled qualified personnel are allowed to perform the described work on the TCU3 controller. Only skilled qualified electricians are allowed to work on the electrical system.
It is essential to comply with the applicable regulations and generally recognised engineering practices when working on EASYLAB components and expansion modules:

- Equipment and Product Safety Act (Geräte- und Produktsicherheitsgesetz (GPSG))
- Industrial Health and Safety Regulations (Betriebssicherheitsverordnung (BetrSichV)) and accident prevention regulations
- General regulations (VGB 1)
- Accident prevention regulations for electrical installations and operating means (BGV A2)

General safety measures

- **Large temperature differences**

  Take care in case of large temperature differences. Do not take the controller into operation immediately if it has been transported from an unheated room to a warm one. Condensation can damage the electronics beyond repair. It takes about 2 hours for room temperature to be reached.
- **Take care when handling and installing expansion modules**

  Possible damage to electrical circuits due to electrostatic charge. Avoid touching components and vias on the main PCB TCU3 or the expansion boards EM-LON or EM-TRF if they are fitted.
- **Take care when installing**

  Risk of injury if the cover plate is folded open. Protect the cover plate using the safety catch and wear gloves if necessary to protect your hands.
- **Foreign matter and liquids**

  Take care if objects or liquids get inside the casing or you notice smells or smoke develops. Have the controller checked by the manufacturer.

Correct use

The electronic controller TCU3 supplements TROX air terminal units for high-speed, variable control of volume flows in supply air, extract air and fume cupboard applications.
Typically, it is used in a group of several controllers for achieving complete room control systems, although it is also possible to operate it as an individual controller.

- The controller is only allowed to be used for the applications listed in the product brochure.
- The installation orientation specified on the installation orientation sticker must be complied with, otherwise the volume flow measurement will not be able to operate correctly.
- The controller is only allowed to be operated within the limits specified in the technical data.

Incorrect use

It is not permitted for the electronic controller to be operated other than in the prescribed installation orientation or in applications that are not stated in the product brochure.

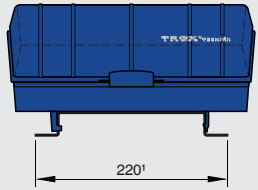
- The controller is not allowed to be used outdoors, in wet areas, or in potentially explosive atmospheres.

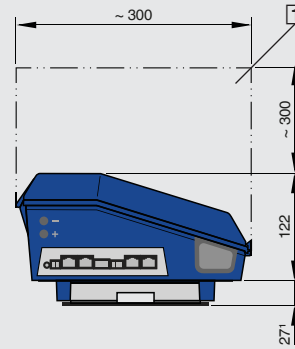
Residual risks

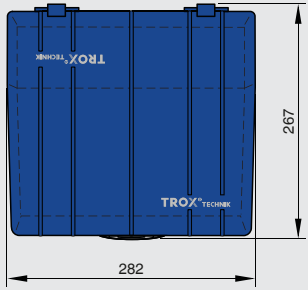
A failure of the electrical power supply will only be bridged if the EM-TRF-USV expansion module is used with the battery pack connected and charged up. In this case, the maximum operating times in UPS mode apply as stated in the technical data. Otherwise, the controller will remain in its final position and restarts when the electrical power supply is restored.

3 Product description

Dimensions



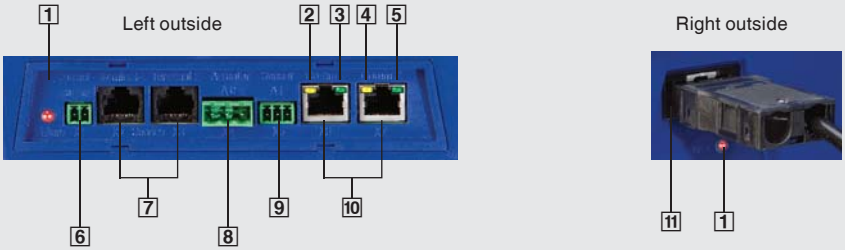




¹ In combination with TAM, TVRK, TVR, TVA, TVZ, TVJ and TVT.
Cannot be combined with TVLK.

1 Keep clear to provide access

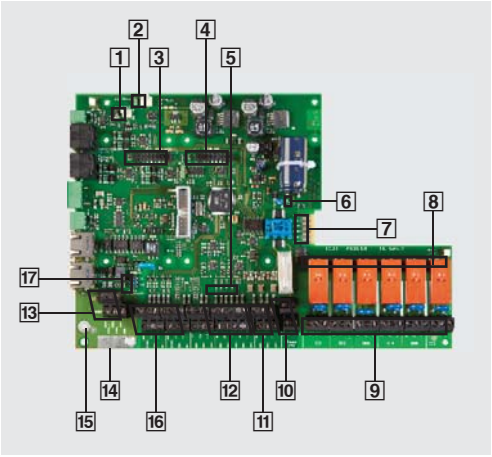
3 Product description
Connections / signalling systems on the outside



	Designation	Description	
1	Red display General error conditions (error LED)	LED switched on	Intermittent: max. 3 s device in switch-on sequence Continuous: error in switch-on sequence
		LED flashing	General error display; more precise diagnosis using the EasyConnect software
		LED flashing slowly	Device function undefined; more precise diagnosis using the EasyConnect software
		LED off	Correct operation; except item 5 is also off → device is not ready
2	Yellow display Termination Communication line	LED switched on	Termination activated
		LED switched off	Termination switched off
3	Green display	Spare; not used at present	
4	Yellow display data reception communication line	LED switched on	Data reception several nodes
		LED on with brief interruptions	Data reception few nodes
		LED off	No data reception from other devices
5	Green display controller operation (heartbeat)	LED flashing slowly	Normal controller operation
		LED flickering	Controller operation and communication to the PC with EasyConnect configuration/ diagnosis software
		LED off	Device not ready
6	Connection for sash contact	Connection of a volt-free switch contact for monitoring the maximum operational sash opening of the sash according to EN 14175 (only for fume cupboard controllers)	
7	Connection for control panel 1, 2	For EASYLAB control panels, e.g. type BE-SEG-xx, BE-LCD-01	
8	Connection for the actuator of the damper blade	Actuator is plugged on at the factory, it is not included with TAM	

9	Connection for analog input AI5	On fume cupboard controller equipment function FH-VS → face velocity transducer; otherwise can be used for connecting variable extract air/supply air volume flow rates by 0-10 VDC signals. (characteristic can be configured)
10	Connection for communication line	For use of network patch cable type SF-UTP
11	Connection for fume cupboard lighting (only with EM-LIGHT expansion module)	Connection socket with 230 VAC assignment, switched by control panel; switch rating of the TCU3 relays 250 VAC 12 A; switch-on current max. 25 A

3 Product description
Connections / signalling systems on the inside



	Designation	Description	
1	Connection valve	Connection for the EM-AUTOZERO expansion module	
2	Connection analog input 1 (AI1)	Connection for the diaphragm pressure transducer fitted on the inside	
3	Expansion slot 1 (ESP-KOM)	Connection for expansion modules such as LonWorks® EM-LON or BACnet expansion or Modbus EM-BAC-MOD-01 expansion and future expansions	
4	Expansion slot 2 (ESP-I/O)	Connection for expansion modules	
5	Visual status displays of the digital inputs DI1 … DI6)	LED switched on	Digital input DI wired up
		LED switched off	Digital input DI not wired up
6	Power 24 V	LED switched on	24 V supply voltage OK
		LED switched off	24 V supply voltage failed / undervoltage
7	Connection surface mains supply	Connection for EM-TRF and EM-TRF-USV expansion modules	
8	Visual status displays of the digital outputs DO1 … DO6	LED switched on	Digital output DO switched
		LED switched off	Digital output DO not switched
9	Terminal block DO1 … DO6	Digital outputs 1..6	Changeover relays
			max. 250 VAC 12 A, switch-on current max. 25 A
10	Terminal block power 24 V	Supply voltage 24 VAC / DC	
11	Terminal block AO1 ... AO3	Analog outputs 1..3	can be configured for analog voltages 0-10 VDC
12	Terminal block DI2 … DI6	Digital inputs 2..6	for volt-free switch contacts

13	Connection COMM-1 Connection COMM-2	Terminals for communication line KL network line type SF-UTP	
14	Clip / connection surface	Wire clamping bracket / shield connection surface communication line KL	
15	Connection for PE	PE earthing screw	
16	Terminal block AI1 … AI4	Analog inputs 1..4	can be configured for analog voltages 0-10 VDC
17	COMM terminator	Switch ON	Communication line KL termination switched on
		Switch OFF	Communication line KL termination switched off

3 Product description

TVR

TVRK

TVLK

TVJ · TVT

TVZ · TVA

Volume flow control with TCU3

For the control of variable supply or extract air flow rates, the electronic controller TCU3 is used in combination with an air terminal unit in the TVR · TVRK · TVLK · TVJ · TVT · TVZ · TVA series.

4 Transport, storage and packaging

Delivery check

Check the supply package immediately after delivery for transport damage and completeness. In case of any damage or an incomplete shipment, inform the shipping company and your TROX contact person immediately.

A complete shipment includes:

- Electronic controller, installed in the closed two-part plastic housing with:
  - Safety catch for the cover
  - 2 plastic cable penetrations (black)
  - 2 reversible cable ties for wire clamping brackets
  - Volume flow rate transducer with tube connection
  - 2-pin plug connector for connection X1
  - 3-pin plug connector for connection X5 (sensor AI)
  - Approx. 5 m network patch cable, type S-FTP green (only for fume cupboard controller, equipment function FH-xxx)
- Expansion modules according to the scope of order documented on the delivery note
- Operating and installation manual

Note

Typically, the EASYLAB controller TCU3 is completely mounted on an air terminal unit in the TVLK TVR TVRK TVA TVZ TVJ TVT series.
According to the project-specific scope of order, the controller is equipped with expansion modules at the factory and delivered complete.

Transport on site

- If possible, take the electronic controller in the transport packaging up to the installation location.
- Do not remove the protective wrapping until just before installation.

Storage

Store the controller temporarily only under the following conditions:

- Leave the unit in its packaging and do not expose it to the effects of weather
- Store the unit in a dry place and away from direct sunlight
- Temperature -10 ... +70 °C, humidity maximum 90% (non-condensing)

Packaging

Dispose of packaging material properly.

5 Technical data

Technical data	
Supply voltage	24 VAC / DC ±15%, 50/60 Hz Optional: 230 VAC mains supply, only when using the EM-TRF expansion module Optional: 230 VAC mains supply with UPS function, only when using the EM TRF USV expansion module
Connecting cable	Terminals with double configuration for lines with connection cross-section up to 2.5 mm^2 Note: The 24 V supply voltage is only allowed to be connected through to a maximum of 5 EASYLAB TCU3 controllers.
Power rating	The maximum power requirement is mainly determined by the specific configuration of the controller. The typical equipment leads to the following values:
	Fume cupboard controller with control panel: 35 VA
	Room controller: 29 VA
	Room controller with room control panel: 33 VA
	With all expansion modules: max. 40 VA
Micro fuse 5 x 20 mm	2 A slow blow, 250 V
Measurement of the volume flow rates	Diaphragm pressure transducer with room air induction to protect the measurement point Optional: automatic zero point correction only with EM-AUTOZERO expansion module
Actuator	Fast-running high-precision actuator, running time for 90°: 3 s
Flow rate correction time	≤ 2 s, depending on duct pressure
Time for return of controller readiness after supply voltage failure	< 500 ms
Plug & play communication system	With automatic recognition of the connected devices and their functions:
	Length of the communication line: max. 300 m
	Number of devices: max. 24 per segment
Temperature range	Operation: 0 ... +50 °C
	Storage: -10 ... +70 °C
Humidity	< 90% non-condensing
Area of application	Within enclosed rooms
Protection level	IP20
IEC protection class	III Protective extra-low voltage

5 Technical data

Connections	
EASYLAB controller communications interface:	• Communication line type S-FTP; (double-shielded) • as plug-in network patch cables • as network roll media • Connection KL via 2 external RJ45 sockets; alternatively interior screw terminals for roll media • terminal resistor can be activated by mini-switches for terminating the communication line • Activation is visualised by external LED for optical monitoring
Digital switching inputs and outputs:	• 6 switching outputs as relay changeover contact loading capacity 250 V, 12 A • 6 switching inputs for connecting volt-free switch contacts
Analog inputs and outputs	• for 0 ... 10 VDC signals with configurable characteristics • 5 analog inputs; input resistance > 100 kΩ • 4 analog outputs; max. output current 10 mA
EASYLAB control panel communications interface:	• up to 2 control panels can be operated at the same time • Connecting cable type S-FTP, max. 40 m possible • Control panels of type BE-SEG and BE-LCD are possible on the fume cupboard controller • Only type BE-LCD is possible on the room controller with activated room management function
Service interface for configuration and diagnosis	• Access on the controller or on the control panel • EasyConnect configuration software with accessories (adapter and configuration cable or BlueCON Bluetooth adapter) required, TROX M-number: B588NF4 or B588NF5
Building management system communications interfaces	• LonWorks® interface FT10A, optionally only with EM-LON expansion module • BACnet MS/TP interface, optionally only with EM-BAC-MOD-01 expansion module (available since mid-2011) • Modbus RTU interface, optionally only with EM-BAC-MOD-01 expansion module (available since mid-2011)
Switched socket for 230 VAC fume cupboard lighting	• optionally only with EM-LIGHT and EM-TRF expansion modules (max. 500 W)

6 Installation

Assembly

For installation, wiring, and commissioning observe the recognised technical regulations, especially safety and accident prevention regulations.
For any wiring work follow the national and local regulations and guidelines for electrical installation.

Danger!
Danger of electric shock! Do not touch any live components!

Electrical equipment carries a dangerous electrical voltage during operation

Only skilled qualified electricians are allowed to work on the electrical system.

Before you perform installation work, switch off the supply voltage to the controller and secure it to prevent reactivation. Only after that is the EASYLAB controller allowed to be installed.

The electronic controller TCU3 is attached to the air terminal unit at the factory (see page 8) and thus forms a functional unit. Refer to the corresponding installation manual for information about installing the expansion modules.

Danger!
Before installing the air terminal unit, check that the electronic controller is firmly seated on the controller.

For installation and fastening of the air terminal unit, refer to the installation manual of the corresponding unit type.
Select the installation location with regard to the conditions stated there so that:

- the TCU3 electronic controller is installed in one of the permitted installation orientations, see illustration on the installation sticker
- the controller housing remains accessible and the cover can be opened widely enough. To do this, provide at least 300 mm clear space in the opening direction of the cover.
- the actuator remains accessible for commissioning and diagnosis.

IMPORTANT: Note the installation orientation
The air terminal unit is not allowed to be installed in combination with the EASYLAB TCU3 controller above or below horizontal ducts. All installation orientations are permitted in vertical ducts.

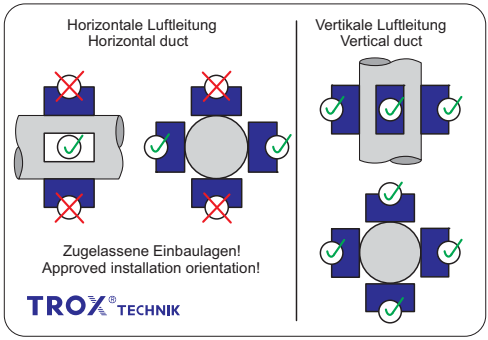


Figure: Installation sticker

Note
The illustrated installation orientations refer to the factory-set delivery condition of the controller, in particular the installation orientation of the diaphragm pressure transducer integrated in the controller for registering the differential pressure in the duct.
Different permitted installation situations are described on the next page.

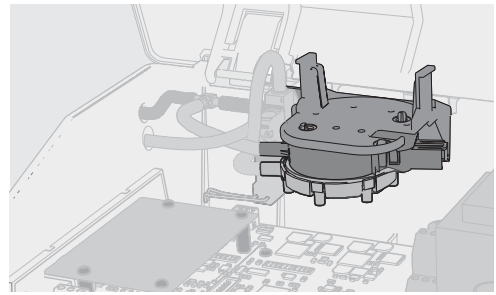
With the introduction of the modified holder (TROX no. M488BA7) for the diaphragm pressure transducer, it can be installed in two different installation orientations within the controller housing.

6 Installation

Factory-set installation position of the diaphragm pressure transducer

In the factory setting, the holder is installed with the transducer in the controller housing in such a way that the installation orientation for the EASYLAB TCU3 controller is as specified on the sticker.

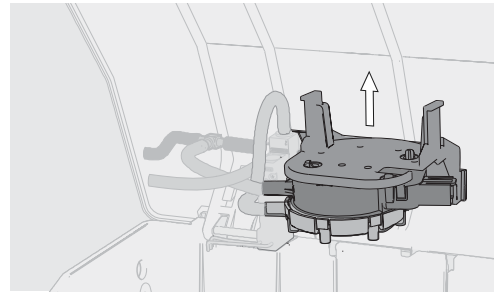
Note
In this transducer installation orientation, installation is not permitted above and below horizontal ducts.

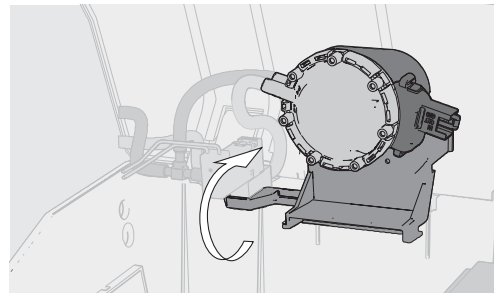


Installation situation of diaphragm pressure transducer
Factory-set delivery

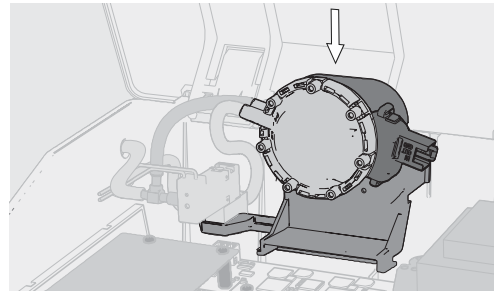
Alternative installation position of the diaphragm pressure transducer

Alternatively, the holder and the transducer can be installed in the controller housing rotated through 90°, thereby permitting installation of the EASYLAB TCU3 controller above and below horizontal ducts. To do this, carefully pull the holder out of the mounting, turn through 90° and push back in. When doing this, make sure that the pneumatic measuring tubes are not kinked, and that the electrical connecting cable is not disconnected either.
Installation situation of diaphragm pressure transducer
Rotated installation situation specifically for controller installation above and below ducts.



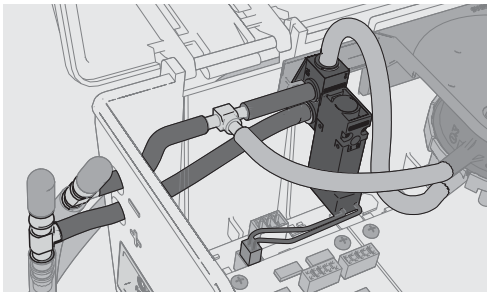


Note
In this transducer installation orientation, neither lateral installation on horizontal air ducts, nor installation on vertical ducts are permitted.



Tubing

Replace the tubing after the new holder has been installed. When doing this, avoid kinking as otherwise the volume flow rate measurement may not work properly.

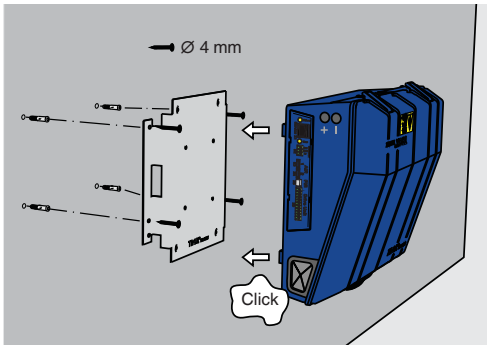


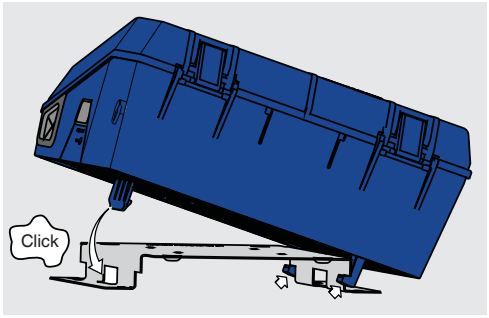
Alternative installation

If space is limited, the EASYLAB TCU3 controller can be mounted on a wall using a bracket (TROX no. E346GL3).

In this case, the same restrictions apply with regard to the installation orientation as described previously.

In this type of installation, pay attention to the factory-set connection lengths of the actuator and the sensor. Extending the electrical connecting cable or measuring tubes is not permitted.





7 Electrical wiring

Danger!
Danger of electric shock! Do not touch any live components!

Electrical equipment carries a dangerous electrical voltage during operation

- Only skilled qualified electricians are allowed to work on the electrical system.
- Before you perform wiring work, switch off the supply voltage to the controller and secure it to prevent reactivation.

Project-specific wiring

- The electrical wiring (see page 16) of the controller must be carried out according to the general and project-specific wiring documents that are provided.

Special wiring instructions

EASYLAB TCU3 supply voltages

- Never connect the 24 V supply if the EM-TRF or EM-TRF-USV expansion module is installed.
- Never connect the 230 V and 24 V supply voltage at the same time.
- Select the dimension of the cable cross-section accordingly

Limited modular wiring of the power supply

If there is a 24 VAC / DC supply, the double terminals are only allowed to be connected through to a maximum of 5 EASYLAB TCU3 controllers. (Limitation of currents on the PCB and terminals)

Polarity of the power supply

The polarity of the supply voltage must be complied with when wiring up AC and DC supplies for all controllers!

EASYLAB TCU3 communication line

- Only one controller with activated room management function (RMF) per communication line
- Terminating resistor for terminating the communication line on the first and last controllers of the communication line.

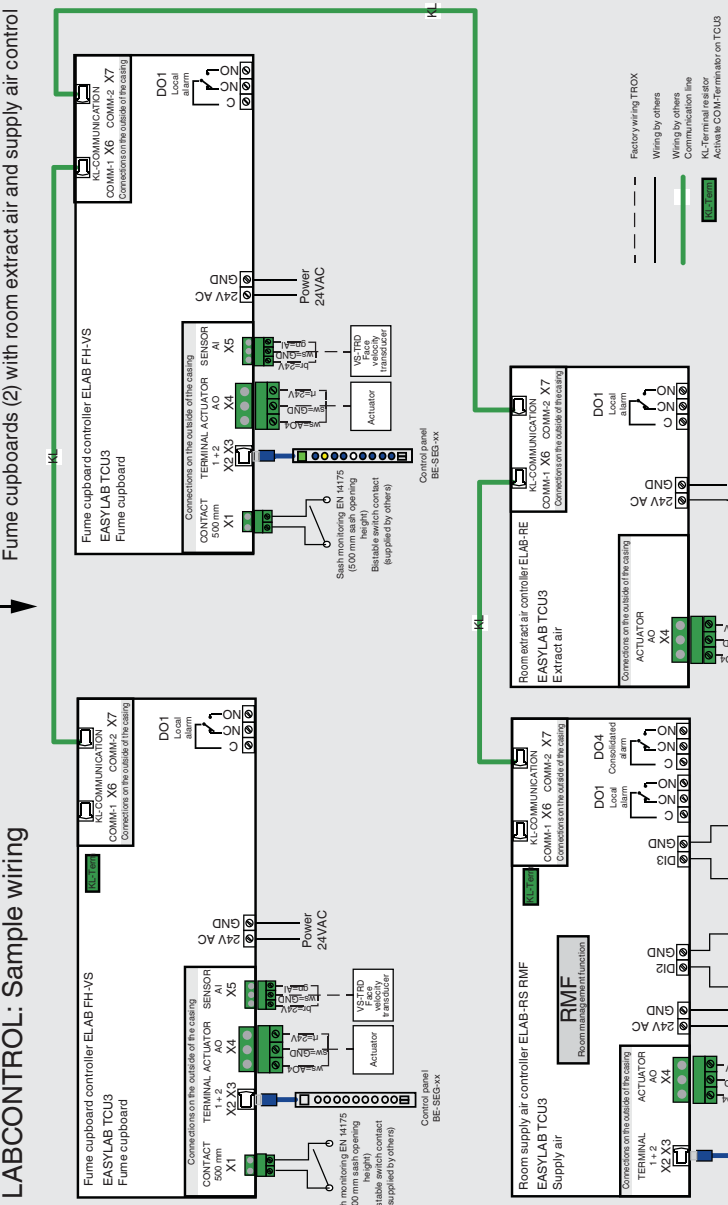
Wire clamping bracket

Use the wire clamping bracket in the housing for all connection cables on the inside!

Line routing

When routing, make sure that the measuring tubes of the sensor on the air terminal unit are not kinked or trapped.

Example


LABCONTROL: Sample wiring
Fume cupboards (2) with room extract air and supply air control
Fume cupboard controller ELAB FH-VS
EASYLAB TCU3
Fume cupboard
Room supply air controller ELAB-RS RMF
EASYLAB TCU3
Supply air
RMF
Room management function
Room extract air controller ELAB-RE
EASYLAB TCU3
Extract air
KL-COMMUNICATION
COMM-1 X6 COMM-2 X7
Connections on the outside of the casing
DO1 Local alarm
DO4 Consolidated alarm
Connections on the outside of the casing
CONTACT 500 mm X1
TERMINAL 1 + 2 X2 X3
ACTUATOR AO X4
SENSOR AI X5
Power 24VAC
24V AC
GND
Actuator
VS-TRD Face velocity transducer
Sash monitoring EN 14175 (500 mm sash opening height)
bistable switch contact (supplied by others)
Control panel BE-SEG-xx
Room control panel BE-CDO-01 (option)
Room operating mode shut-off Volt-free contact closed = Controller CLOSED (switch by others)
Room operating mode reduced (stand-by) Volt-free contact closed = Stand-by (switch by others)
KL
Factory wiring TROX
Wiring by others
Communication line
KL-Terminal resistor
Activate COM-Terminator on TCU3

8 Commissioning

Commissioning

The controllers are supplied with factory settings according to the order.
Commissioning of the controller must be carried out according to the project-specific specifications and the project-specific wiring documents that are provided.

Step 1: Checking / adapting the configuration settings

Using a PC / notebook and the TROX EasyConnect configuration software, it is possible to verify the configuration settings and adapt them if required.

- **Connection set-up with EASYLAB configuration cable**

  For this purpose, the PC is connected to the EASYLAB controller using an USB-RS485 interface adapter and a specially prepared configuration cable.

  The components required are included in the accessory part with the TROX M-number: B588NF4.

- **Connection setup with BlueCON Bluetooth adapter**

  Alternatively, wireless communication can be established between the controller and PC using the BlueCON Bluetooth adapter.

  For this purpose, it is necessary to have a Bluetooth interface on the PC/notebook (integrated hardware or external expansion e.g. as USB stick) and the BlueCON module plugged into the controller.

BlueCON
Bluetooth adapter module
TROX M number: B588NF5

Step 2: Zero point correction volume flow rate transducer

For TCU3 controllers without EM-AUTOZERO expansion module, it is necessary to perform a zero point correction for the volume flow rate transducer as part of commissioning.
The EasyConnect software automatically detects the system configuration and displays the corresponding dialog automatically for the person performing commissioning.
Disconnect the measuring tubes from the sensor according to the instructions there, and trigger the zero point correction. Then reconnect the measuring tubes.
This commissioning step is not required for controllers equipped with the EM-AUTOZERO expansion module.

8 Commissioning

Step 3: Actuator adaptation

Adaptation must be carried out during commissioning for air terminal units with TROX actuator type NMQ24A-SR TR (M466EQ0). This ensures correction of any misalignment in the motor position when the power is off, e.g. during transport or installation, so the controller can operate without faults.
The green adaptation key on the actuator must be pressed for this purpose.
The status LED (orange) on the actuator lights up to acknowledge the adaptation process, and the actuator moves to the limit stops. The status LED is switched off after the procedure.

Step 4: Function test of the controller

At the end of commissioning, perform a function test on the controller in accordance with the project specifications for the required operating modes. The volume flow rate setpoints set for the operating modes must be compared with the actual values achieved, and documented.

9 Maintenance
10 Decommissioning

Operation and maintenance

The controller electronics themselves are maintenance-free.
However, there are special maintenance requirements for operating the air terminal unit depending on the range of applications. For example, fume cupboard controls must be subjected to an annual function check according to DIN 12924, EN 14175 BGR 120 and TRGS 526.
The system owner is responsible for operational safety.
Before working on the controller electronics, switch off the supply voltage to the device and secure it to prevent reactivation.

Performing zero point correction

The volume flow rate transducer must be subjected to cyclical zero point correction in order to ensure that the volume flow rate is being measured accurately over the long term.

Requirement for TCU3 controller without EM-AUTOZERO controller:

Perform a manual zero point correction at least once a year as part of the functional test/ maintenance.

To do this, disconnect the measuring tubes from the sensor and trigger the zero point correction using the Diagnosis – I/O dialog box in the Easy-Connect software. Then reconnect the measuring tubes.
EASYLAB TCU3 controllers with EM-AUTOZERO expansion module automatically perform a cyclical zero point correction.

Defective fuse

If the fuse blows, carry out fault diagnosis and rectify the fault before renewing the fuse.

Removing the electronic controller

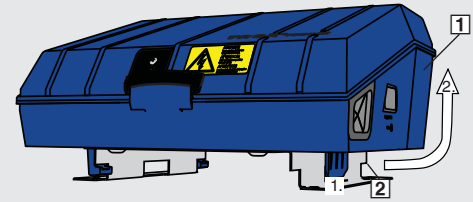
If the TCU3 electronic controller is to be renewed (spare part), first remove the electrical connections and then the pneumatic connections.

Danger!

Danger of electric shock! Do not touch any live components!

Electrical equipment carries a dangerous electrical voltage during operation

- Only skilled qualified electricians are allowed to work on the electrical system.
- Before you perform work, switch off the supply voltage to the controller and secure it to prevent reactivation.



1. Release fixing brackets with a screwdriver
2. Remove the TCU3 controller upwards.

If necessary, the TCU3 controller can also be attached without a bracket on the air terminal unit, e.g. TVLK.

[1] TCU3 controller
[2] Bracket